US007252109B2

(12) **United States Patent**
Colombo

(10) **Patent No.: US 7,252,109 B2**
(45) **Date of Patent: Aug. 7, 2007**

(54) **SAFETY DEVICE FOR A LIGHTING VALVE OF A GAS BURNER**

(75) Inventor: **Pierangelo Colombo**, Gallarate (IT)

(73) Assignee: **Industrias Unidas S.A. DE C.V.** (MX)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 300 days.

(21) Appl. No.: **11/102,275**

(22) Filed: **Apr. 8, 2005**

(65) **Prior Publication Data**

US 2005/0233273 A1 Oct. 20, 2005

(30) **Foreign Application Priority Data**

Apr. 8, 2004 (IT) TO2004A0218

(51) **Int. Cl.**
F23Q 9/08 (2006.01)
F23D 14/72 (2006.01)

(52) **U.S. Cl.** **137/66**; 137/614.19; 137/614.21; 431/54

(58) **Field of Classification Search** 137/66, 137/65, 614.19, 614.21; 431/54, 53
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,297,856 A * 10/1942 Ames 431/59
4,081,235 A * 3/1978 van der Veer 431/54
4,242,080 A * 12/1980 Tabei 431/54
4,442,853 A * 4/1984 Gort 137/66
6,886,581 B2 * 5/2005 Harniet 137/66

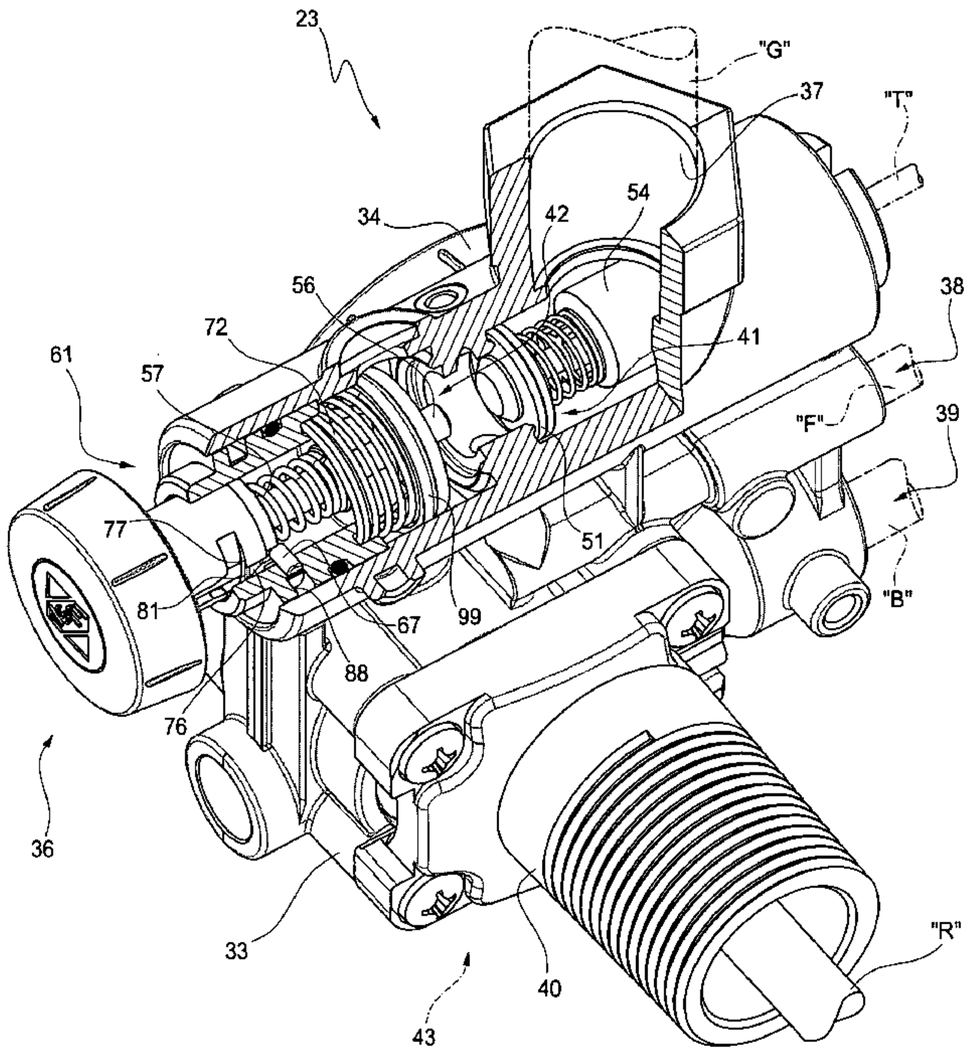
* cited by examiner

Primary Examiner—Kevin Lee
(74) *Attorney, Agent, or Firm*—Baker & McKenzie LLP

(57) **ABSTRACT**

A safety device (**61**) for a lighting valve (**23**) of a gas burner, comprising a starting button (**36**), a return spring (**57**), a cutoff shutter (**42**) controlled by the starting button (**36**), a control shutter (**41**) for a pilot light nozzle, and a holding electromagnet (**54**) for the control shutter (**41**). The control shutter (**41**) is normally closed and is actuatable through the starting button (**36**) for the flowing of the gas to the pilot light nozzle, whilst the holding electromagnet (**54**) is dependent on the pilot light to hold open the control shutter (**41**). The starting button (**36**) is provided for rotation and can be depressed only for a given angular start position so that, for starting the lighting, the button (**36**) must be rotated up to said start position and subsequently depressed to close the cutoff shutter (**42**) and open the control shutter (**41**). There are provided a hooking condition and an unhooked condition for the starting button: in the hooking condition, the cutoff shutter (**42**) is closed and the control shutter (**41**) is open under the control of the holding electromagnet (**54**) without being influenced by the starting button (**36**); and, in the unhooked condition, the starting button (**36**) can return to the lifted position to open the cutoff shutter (**42**) for the flowing of the gas to the burner, the unhooked condition requiring a further rotation of the starting button (**36**) spaced away from the angular start position.

16 Claims, 8 Drawing Sheets



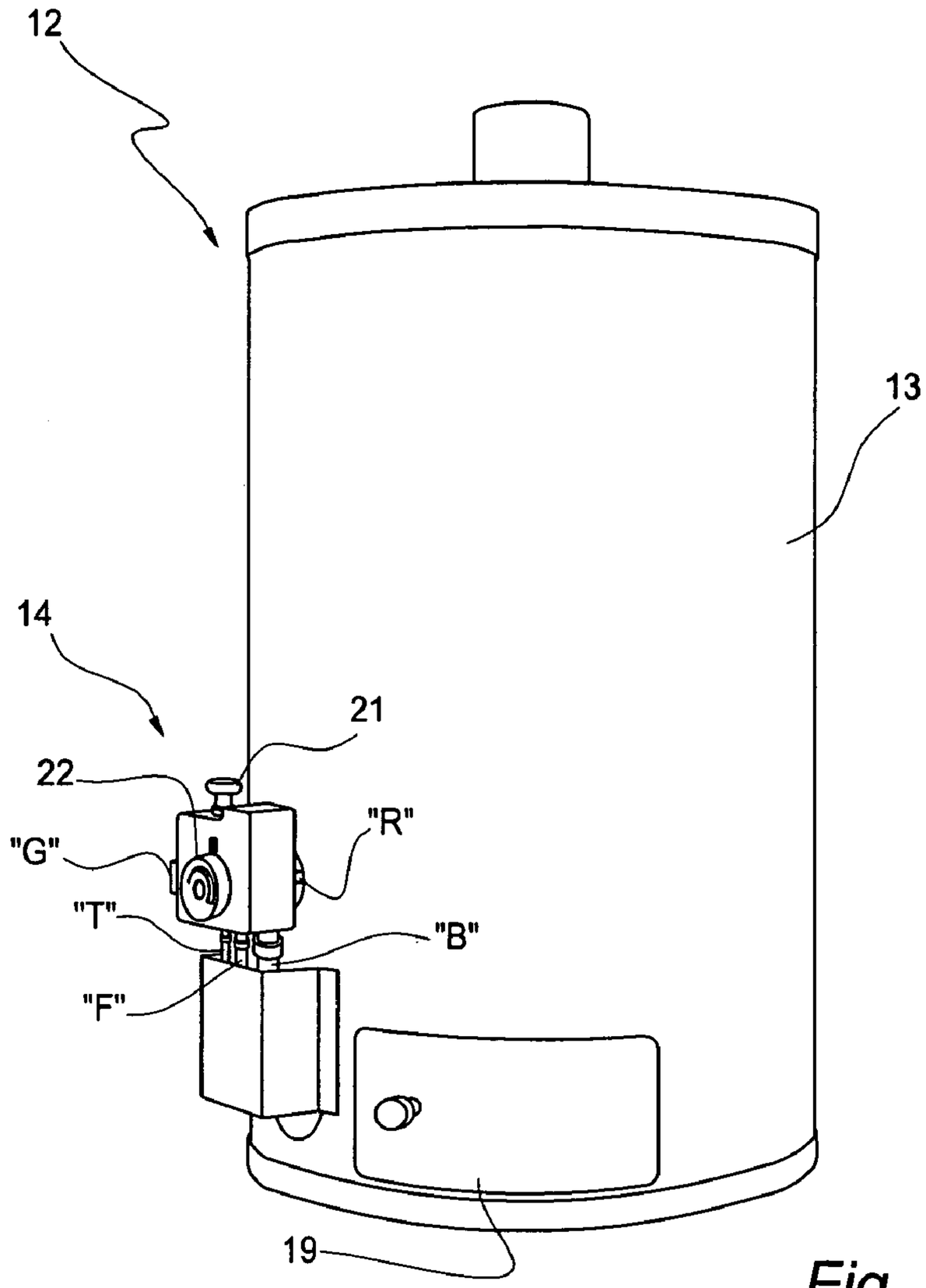


Fig. 1

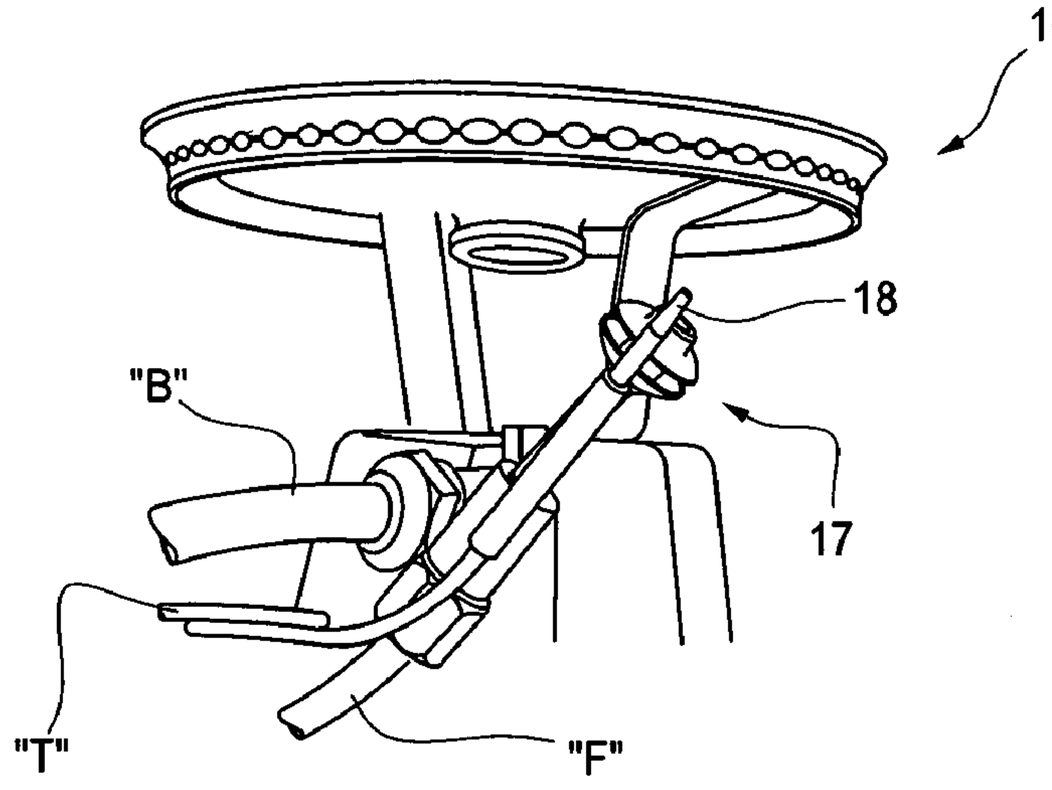


Fig. 1a

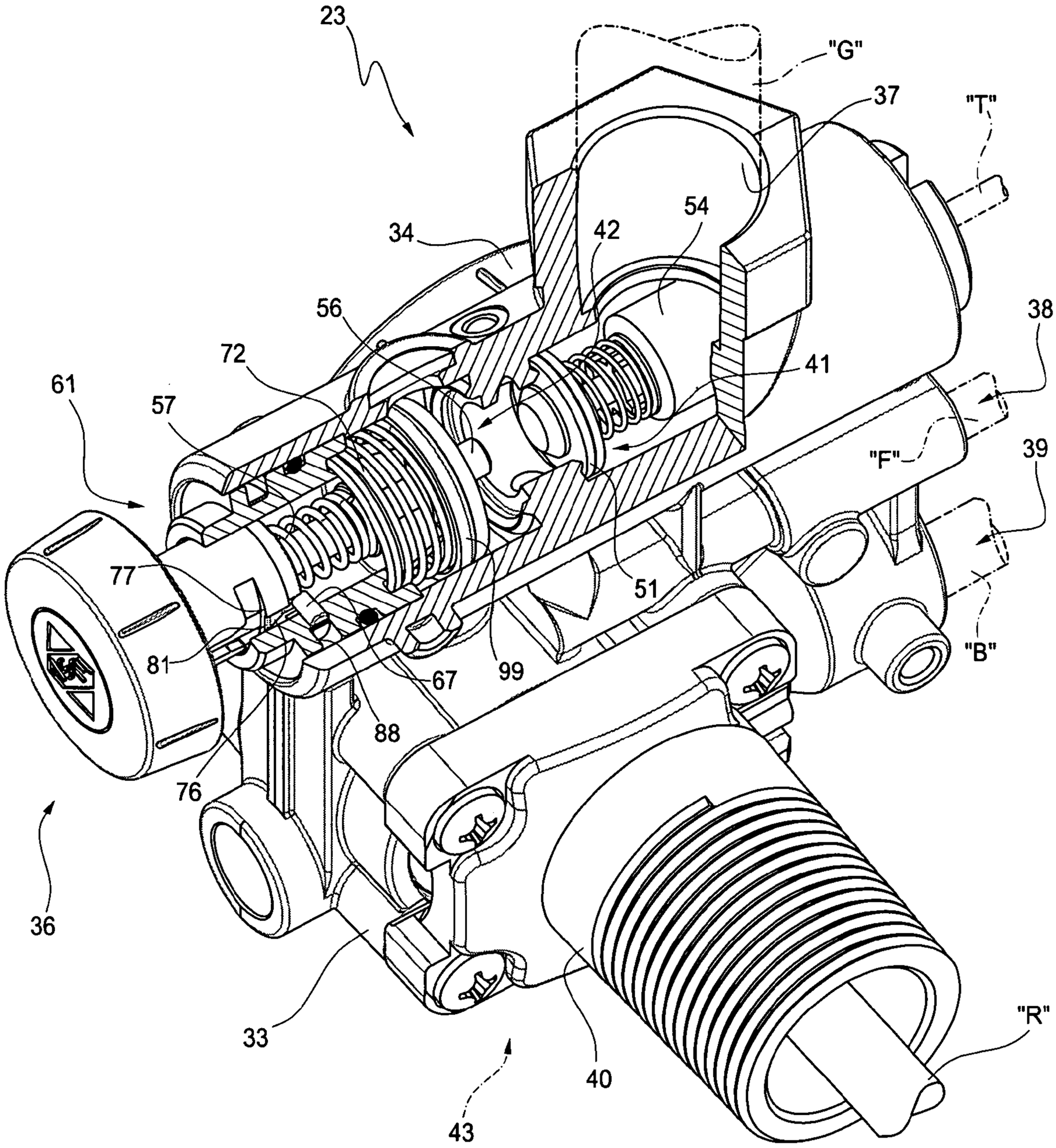

23
"G"
37
"T"
54
42
34
56
72
38
41
61
57
"F"
39
77
51
81
67
99
"B"
88
76
36
33
43
40
"R"

Fig. 2

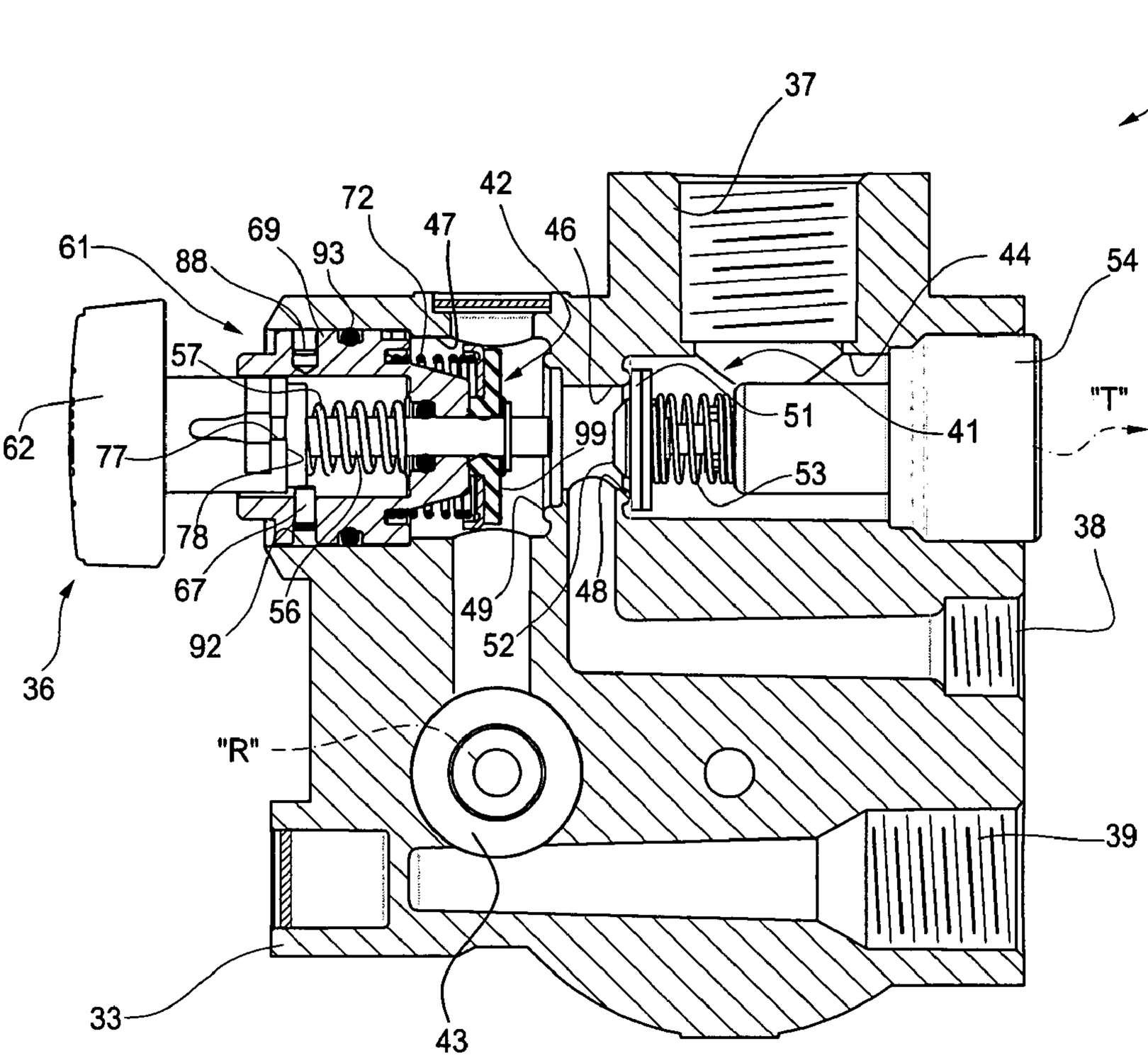

23
37
42
72
47
46
69
93
61
88
44
54
57
62
77
99
51
41
"T"
53
78
38
67
48
49
56
52
92
36
"R"
39
33
43

Fig. 3

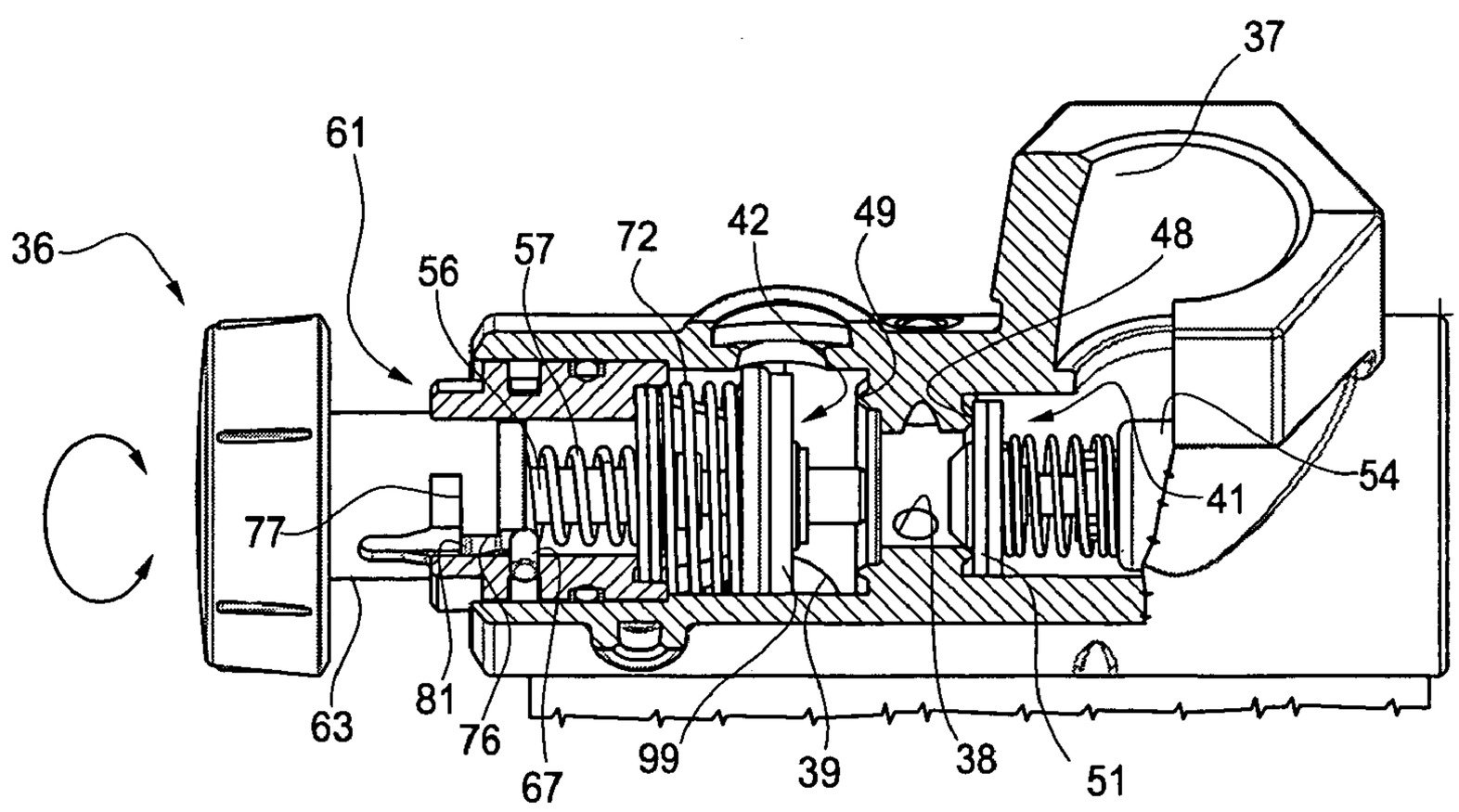

37
61
36
56
57
72
42
49
48
54
41
77
63
81
76
67
99
39
38
51

Fig. 4a

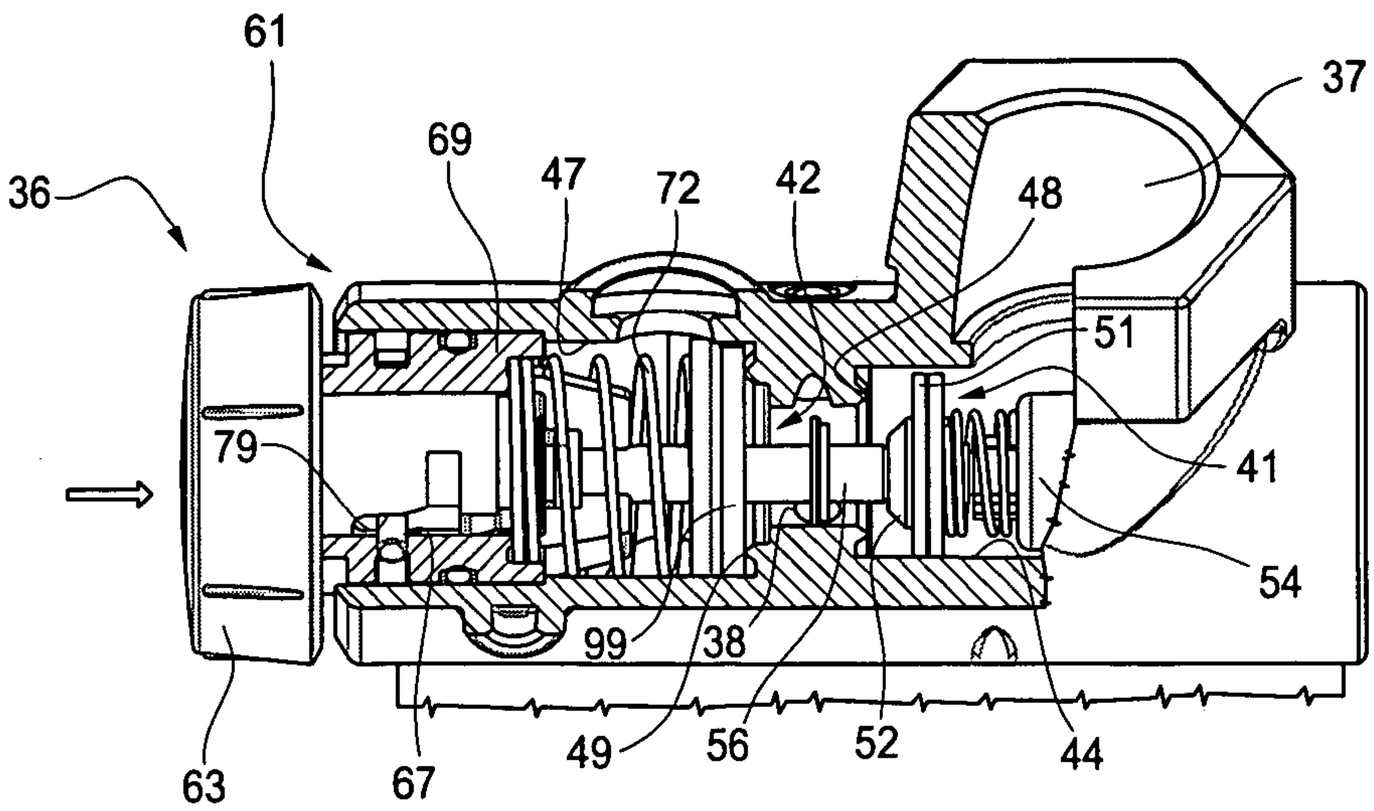


Fig. 4b

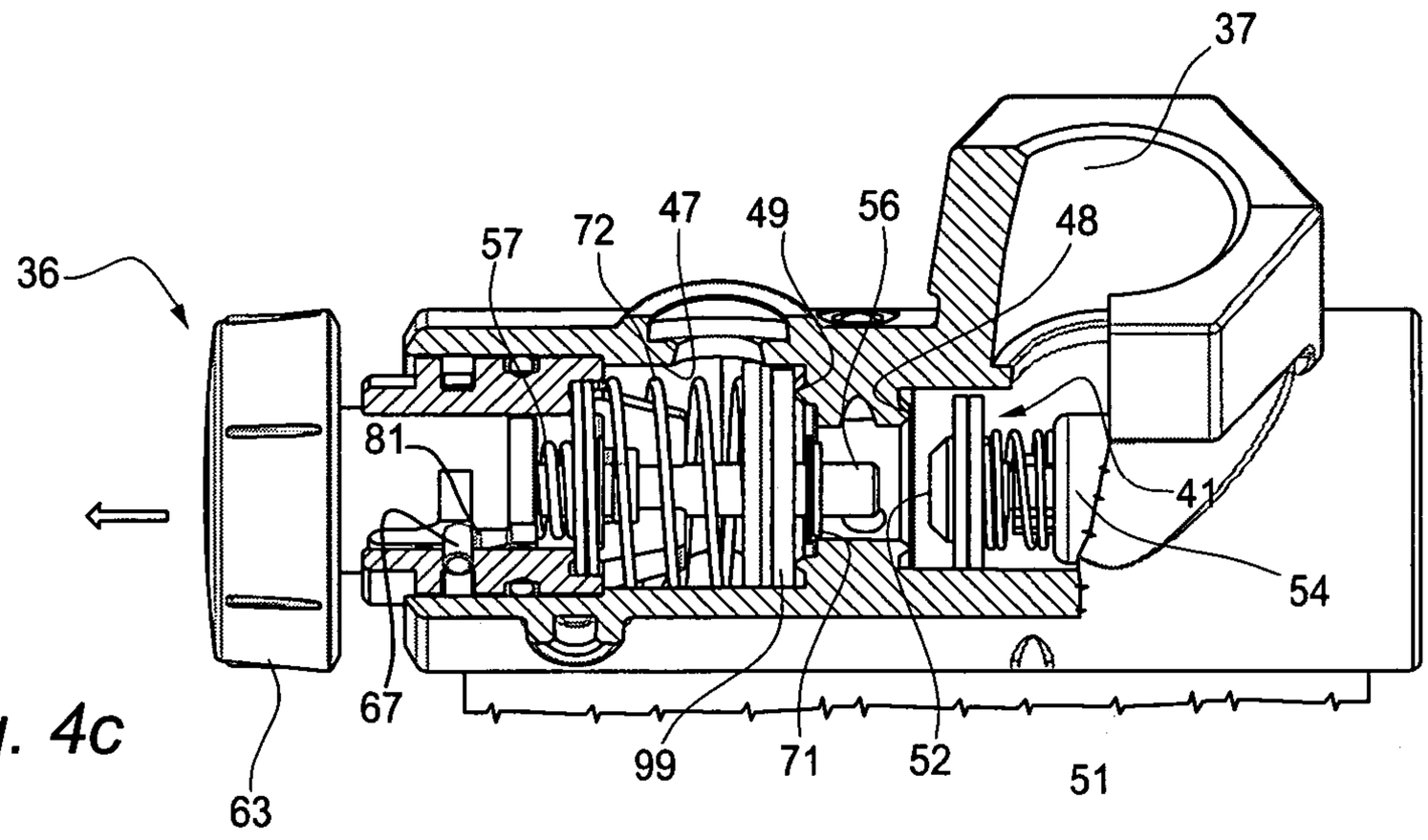


Fig. 4c

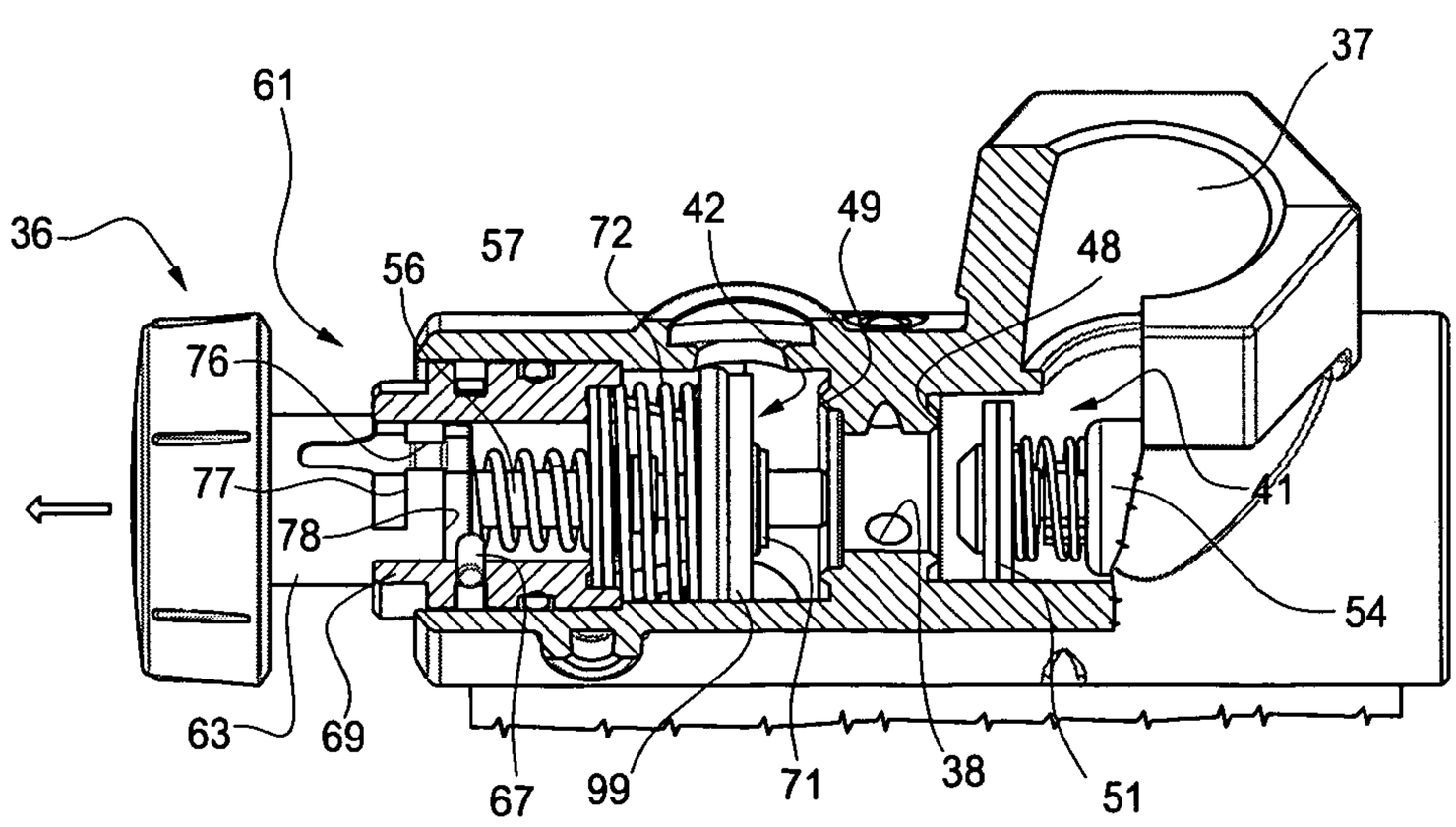


Fig. 4d

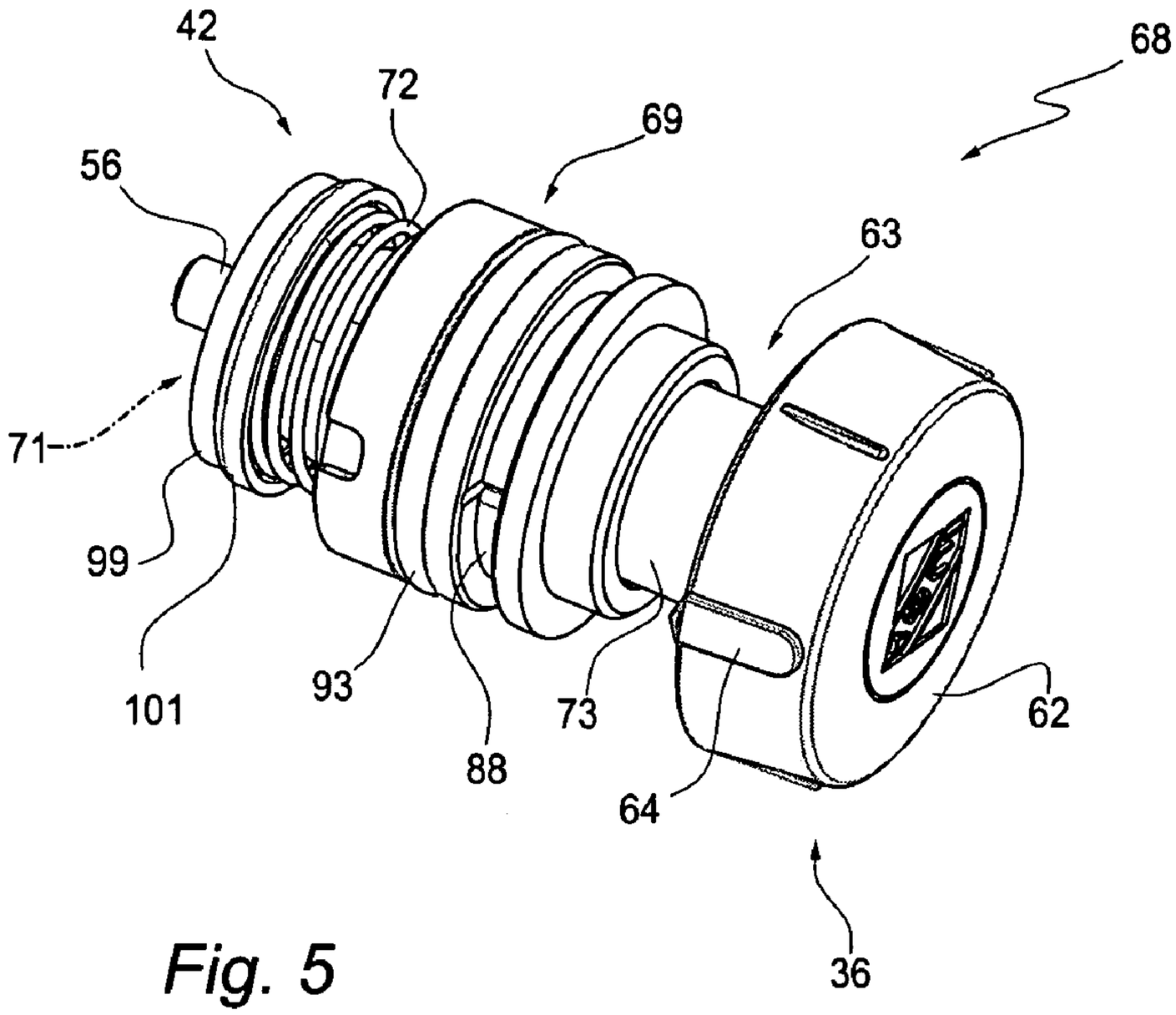

42
72
68
69
56
63
71
99
101
93
88
73
64
62
36

Fig. 5

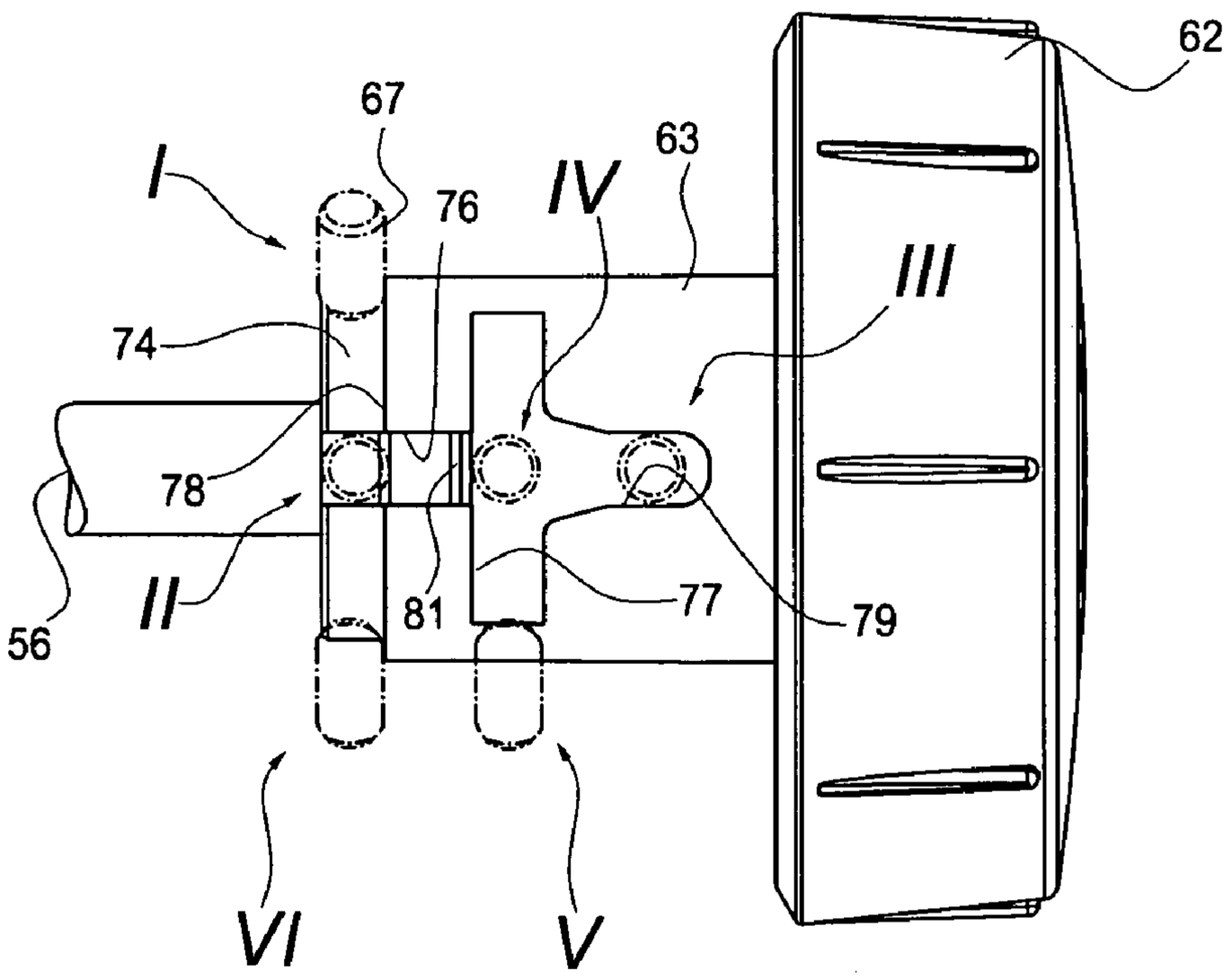

62
67
I
63
IV
76
III
74
78
II
56
81
77
79
VI
V

Fig. 6

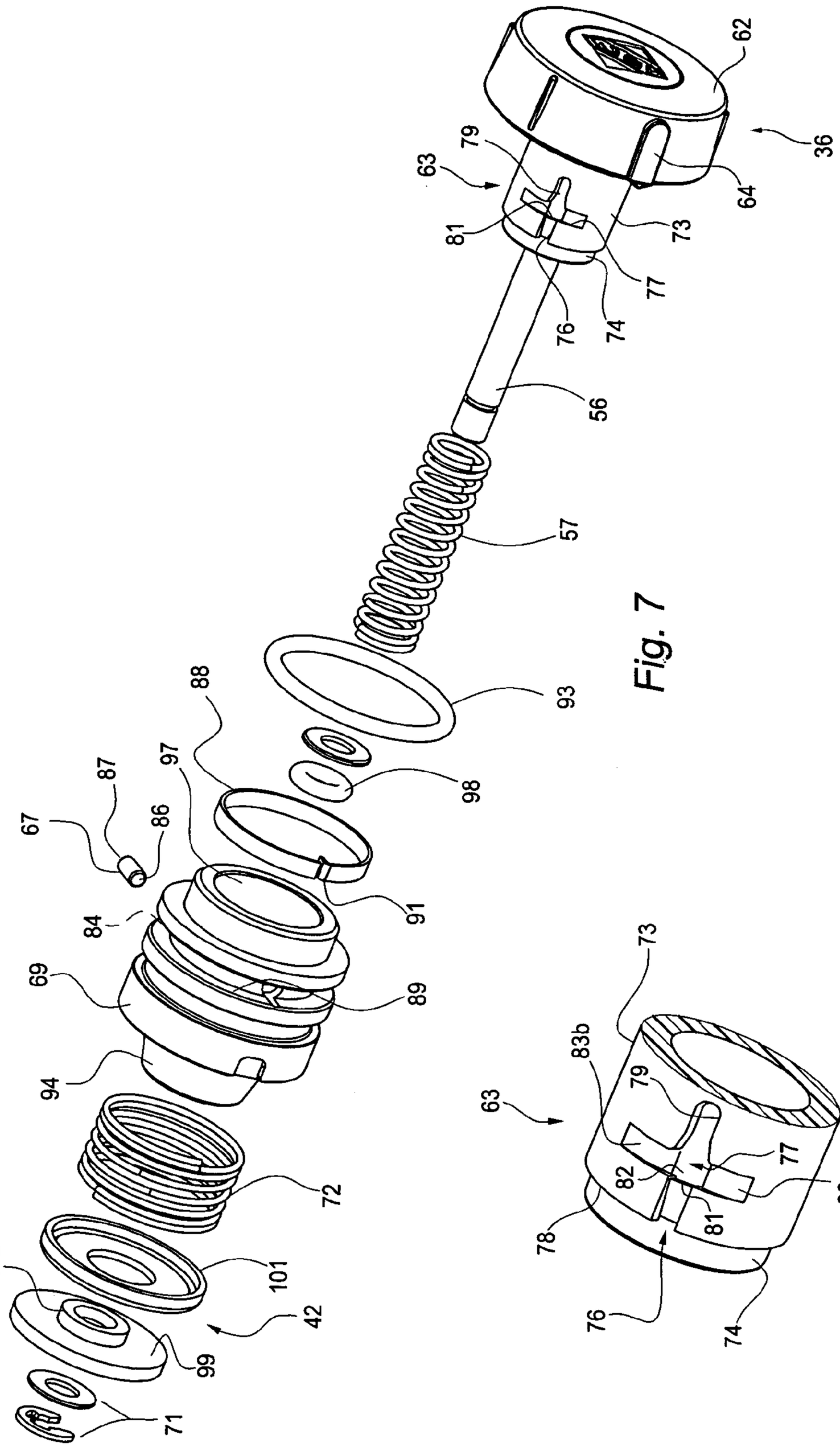

62
36
79
63
64
81
73
77
76
74
56
57
93
88
97
87
67
86
98
84
91
69
89
94
72
102
101
99
42
71

Fig. 7

73
83b
79
63
77
82
83a
81
78
76
74

Fig. 8

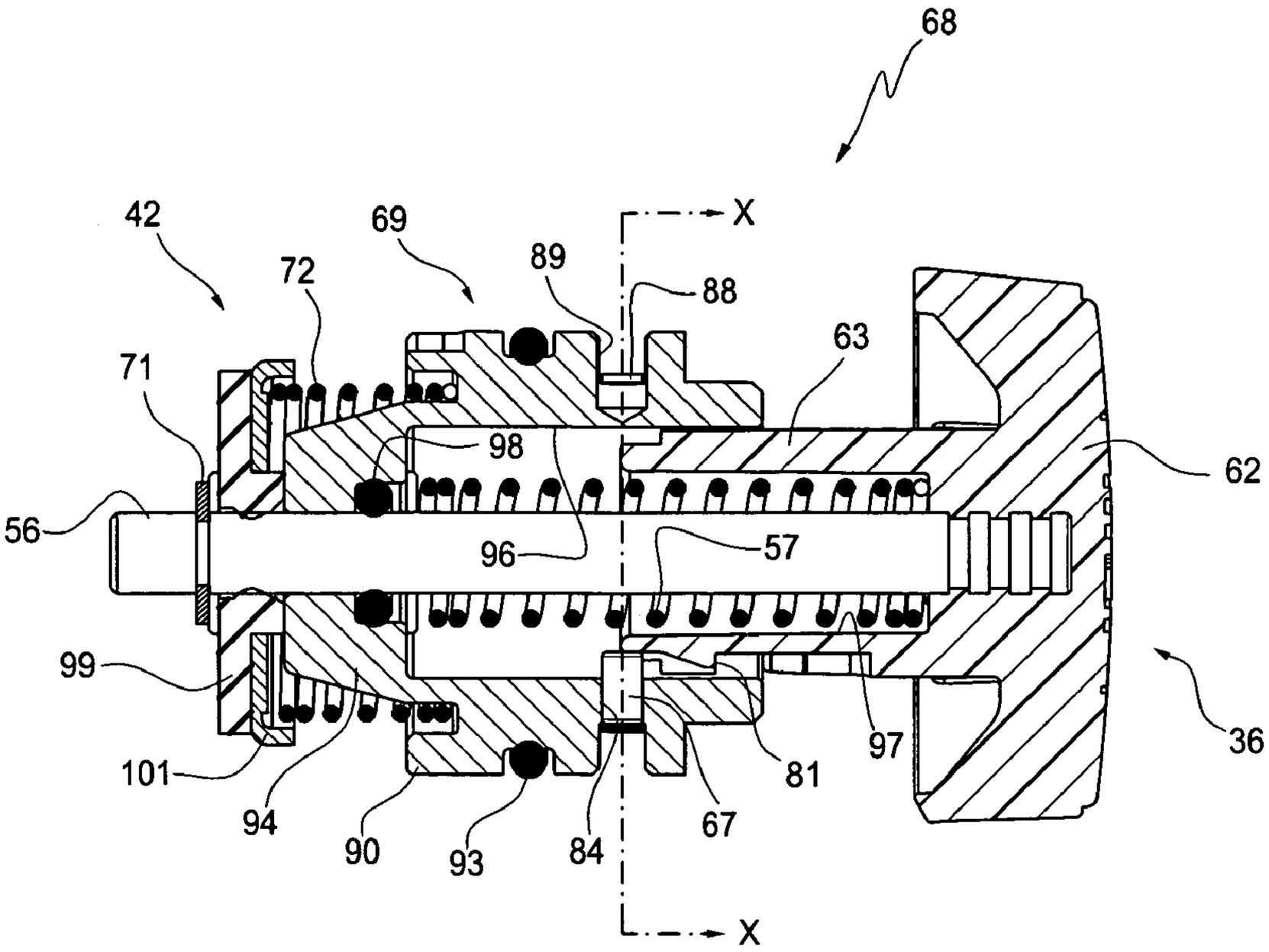

68
42
69
X
89
72
88
63
71
98
62
56
96
57
99
97
36
101
81
94
90
93
84
67
X

Fig. 9

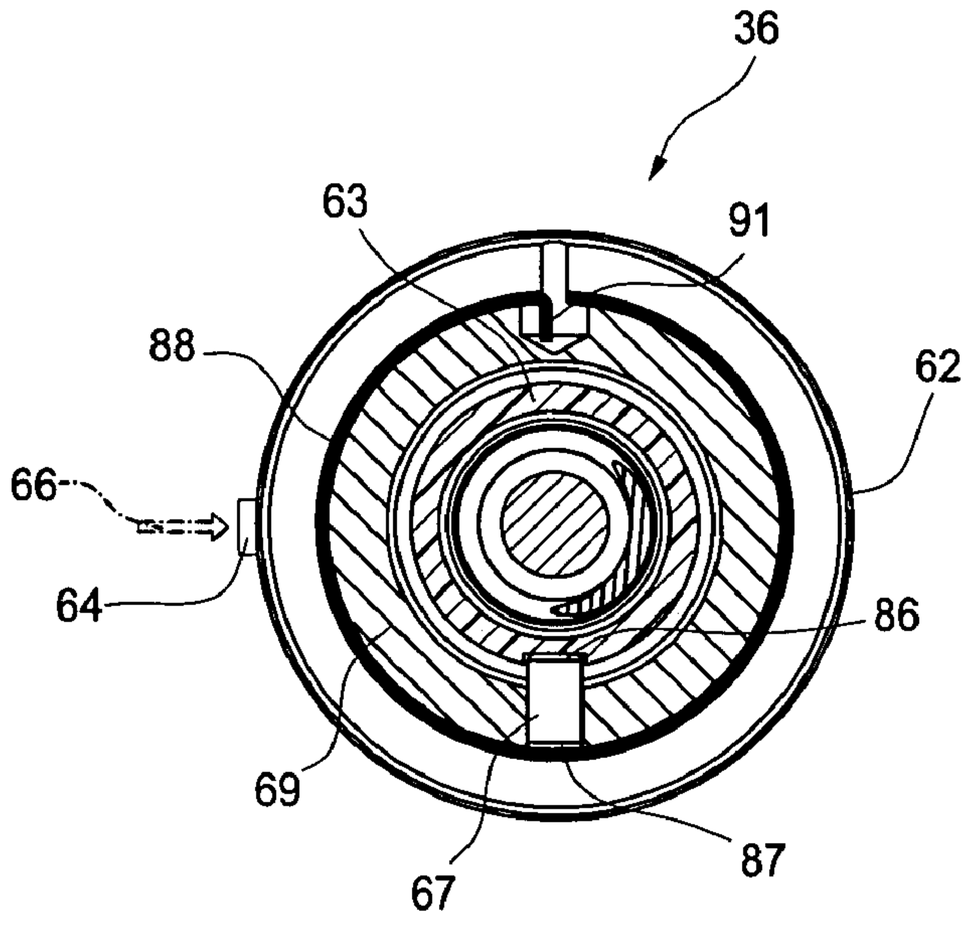
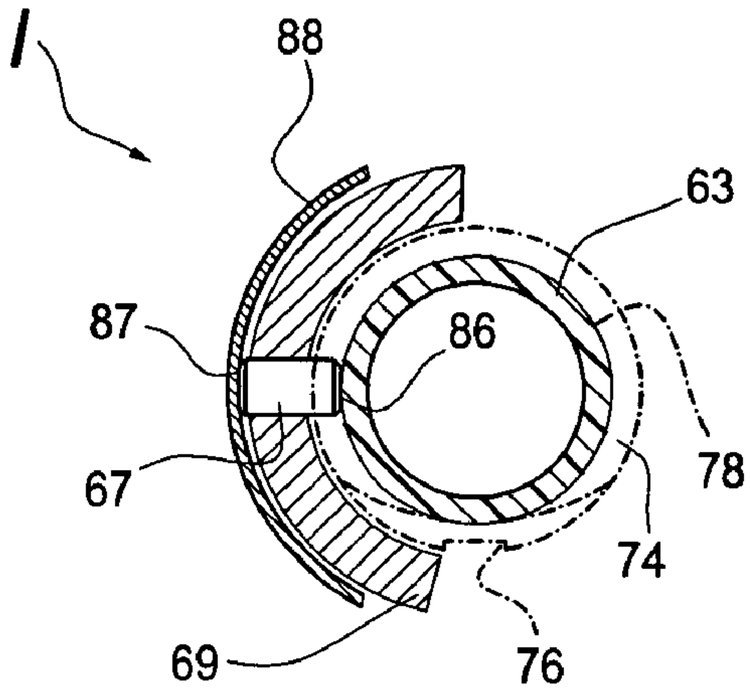
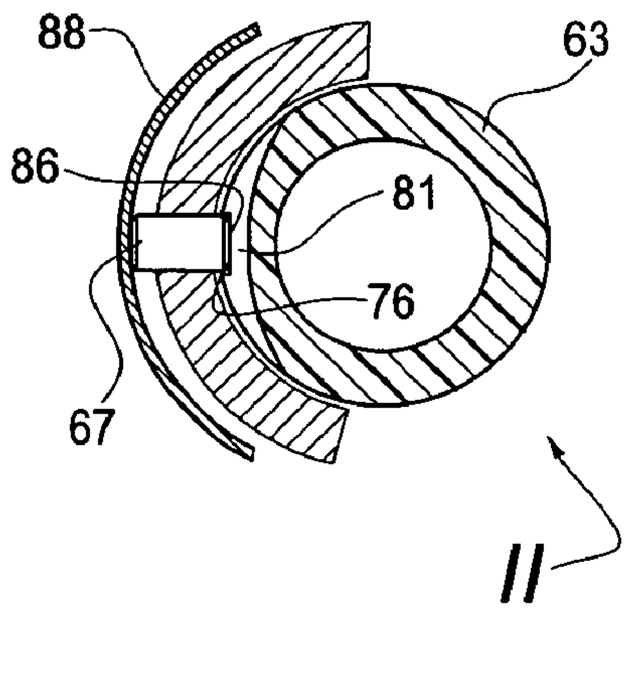
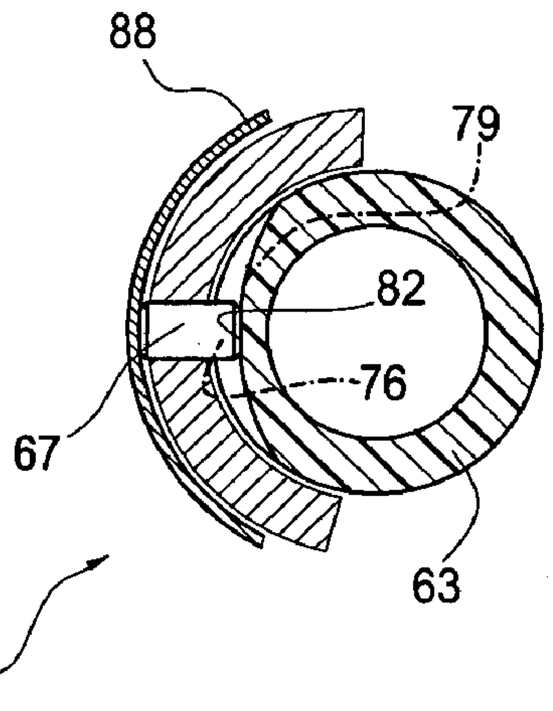

36
63
91
88
62
66
64
86
69
87
67

Fig. 10


I
88
63
87
86
78
67
74
69
76


88
63
86
81
76
67
II


88
79
82
76
67
63
III-IV

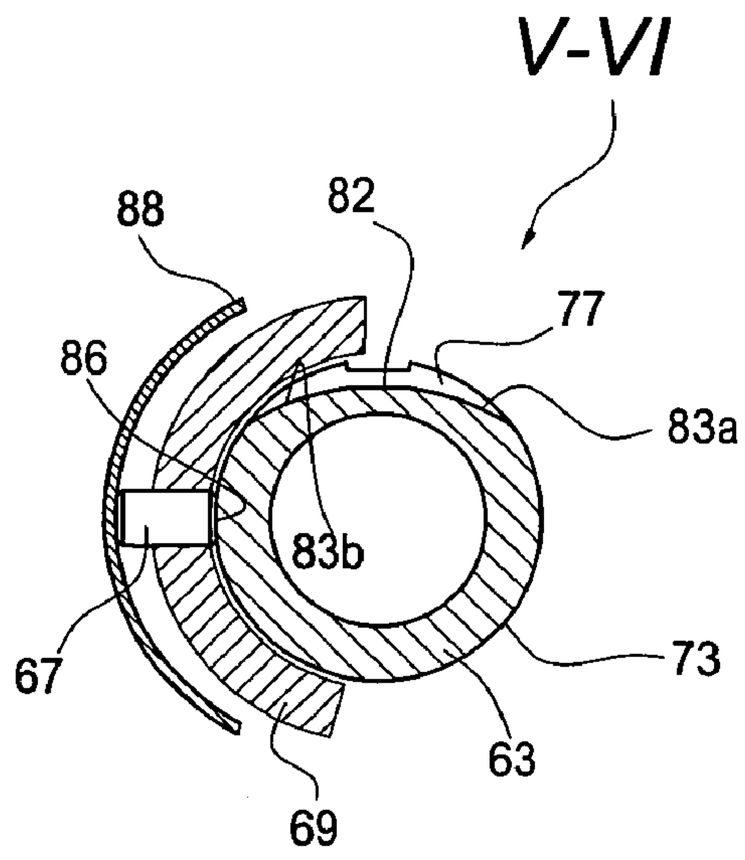

V-VI
88
82
77
86
83a
83b
67
73
63
69

Fig. 11

SAFETY DEVICE FOR A LIGHTING VALVE OF A GAS BURNER

PRIORITY CLAIM AND RELATED APPLICATIONS

This application claims priority to Italian Patent Application No. TO2004A000218 entitled "Dispositivo di sicurezza per valvola d'accension di un bruciatone a gas" filed Apr. 8, 2004, incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to a safety device for a lighting valve of a gas burner, exemplary for water heaters.

More specifically, the invention relates to a safety device for a lighting valve of a gas burner, exemplary but not exclusively, for domestic water heaters, comprising a starting button, a control shutter actuatable through the starting button and a cutoff shutter controlled by the starting button, according to the introductory portions of the principal claims.

BACKGROUND OF THE INVENTION

A gas water heater generally provides a control pilot light for the main burner, a regulating device for the burner controlled by manual controls and by the temperature of the water and a safety device, which prevents the flowing of the gas to the burner in the case of turning off the pilot light.

Although water heaters with burners provided of piezoelectric or electronic type lighting devices are normally on sale, water heaters having flame lighting system for the gas burners are still commonly produced.

In a safety device for a gas water heater of known type, the cutoff shutter is downstream of the control shutter and upstream of a thermostatic shutter for the main burner. The control shutter is also controlled by a holding, electromagnet, in turn fed by the current of a thermocouple heated by the pilot flame. The thermostatic shutter is adjustable through a knob, which further provides a given start position, of minimum feed, for the gas burner.

In the condition of rest, the cutoff shutter is open and the control shutter is closed. When is depressed, the starting button closes the cutoff shutter and opens the control shutter. In this condition, the user can light the pilot light whilst, for the action of the thermocouple, the electromagnet holds open the control shutter. A following lifting of the button opens the cutoff shutter and allows the flow of the gas to the burner under the control of the thermostatic shutter and its automatic lighting by the pilot light.

The known safety device is generally effective to prevent the feeding of the main burner before the lighting of the pilot light, avoiding risks of saturation of the combustion chamber and consequent bursts. Nevertheless, the phase of starting of a lighting valve can be source of problems, particularly in the cases in which the user manually lit the pilot light by means of matches, lighters and free flames. A particular risk arises when the thermostatic shutter is open and the user unintentionally releases the starting button before moving away the hand from the area of the pilot light. A sudden lighting of the main burner during the return to rest of the button can cause fear and burns in the most unfavorable cases.

However, also if a water heater provides a piezoelectric or electronic system for the lighting of the pilot light, the safety device above described can cause problems. It may depend on improper sequences in the depression/lifting operations of the starting button and/or to anomalies in the functioning of the system, with hazards of leaks of gas in the combustion chamber and consequent hazards of bursts.

SUMMARY OF THE INVENTION

An object of the invention is to accomplish a safety device for a lighting valve of gas burners, exemplary for water heaters, which assures high security standards together with easiness of operations for the user.

This object is attained by the safety device for lighting valve of a gas burner, exemplary for domestic water heaters according to the characteristic portions of the principal claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics of the invention will become clear from the description that follows, provided merely by way of non-restrictive example, with the aid of the accompanying drawings, in which:

FIGS. **1** and **1***a* show schematic views of a water heater with a relative lighting valve and a gas burner of known type;

FIG. **2** shows a perspective view, partially sectioned, of a lighting valve of a gas burner with a safety device for the water heater shown in FIG. **1**, according to the invention;

FIG. **3** represents a schematic section of the valve of FIG. **2**;

FIGS. **4***a*-**4***d* show perspective schematic views of details of the valve of FIG. **2** in different working configurations;

FIG. **5** represents, in a perspective view, a component group of the safety device according to the invention;

FIG. **6** shows a scheme of operation of a detail of the group of FIG. **5**;

FIG. **7** represents an exploded view of the component group of FIG. **5**;

FIG. **8** shows a detail, in enlarged scale, of the group of FIG. **7**;

FIG. **9** is a schematic sectioned view of the component group of FIG. **5**;

FIG. **10** shows a section according to the line X-X of the group of FIG. **5**; and

FIG. **11** shows, in enlarged scale, details of the section of FIG. **10** in different working configurations.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** represents a gas water heater **12** for domestic use of known type. The water heater **12** includes a container **13** and a lighting valve **14** and provides a combustion chamber with a main burner **16** (FIG. **1***a*), a nozzle **17** for a pilot light and a thermocouple **18** inside the container **13**. The thermocouple is located in the path of the pilot flame and is electrically connected to leads protected by a tubular element "T". The water heated by the burner **16** is accumulated in a reservoir not shown in the figures and a (not shown) thermostat through a conduit "R" controls its temperature.

The lighting valve **14** is outside the water heater **12**, whilst the nozzle **17** for the pilot light is accessible through a door **19** of the container **13**. The gas, as methane, liquid gas etc. enters into the valve **14** through an input pipe "G" and the valve **14** feeds the nozzle **17** through a pipe "F" and the burner **16** through a pipe "B". The valve **14** is connected with the thermocouple **18** and the thermostat through the

leads of the element "T" and through the conduit "R", respectively. In particular, the lighting valve **14** includes a starting button **21** for the feeding of the pilot light and a knob **22** for regulating the temperature of the water in the reservoir.

FIG. **2** shows a lighting valve **23**, which can replace the known valve **14** of FIG. **1** and to which the safety device of the invention is applied. The lighting valve **23** includes a valve body **33**, a control knob **34** similar to the knob **22**, and a starting button **36**.

An inlet **37**, ducts **38** and **39** and a sleeve **40** for the conduit "R" of the thermostat are evident in the valve body **33**. The inlet **37** is connectable with the input pipe "G", whilst the duct **38** is connectable with the pipe "F" for the nozzle of the pilot light and the duct **39** is connectable with the pipe "B" for the burner. Further, the valve body **23** lodges a control shutter **41**, a cutoff shutter **42** and a thermostatic shutter **43** (FIG. **3**), all of disk type.

The inlet **37**, and the ducts **38** and **39** are connected each the other through an input chamber **44**, an intermediate chamber **46** and a cutoff chamber **47**, respectively. The input chamber **44** is gas connected with the inlet **37**; the intermediate chamber **46** is interposed between the chambers **44** and **47** and is in gas connection with the duct **38** for the nozzle of the pilot light; and the cutoff chamber **47** is gas connected with the duct **39** for the burner.

The chambers **44** and **47** lodge the control shutter **41** and the cutoff shutter **42**, respectively. The output of the input chamber **44** and the input of the cutoff chamber **47** are delimited by shutter seats **48** and **49** for the disks of the shutter **41** and of the shutter **42** and these seats put the intermediate chamber **46** in gas connection with the chambers **44** and **47**. The seats **48** and **49** are of circular section, parallel each the other and substantial coaxial.

The control shutter **41** is in axis with the seat **48** and comprises a gastight disk **51** and a contrast head **52** mounted on a free end of an actuating stem **56**. The disk **51** normally closes the seat **48** for the action of a spring **53**, whereby preventing, in the use, the flowing of the gas from the input chamber **44** to the intermediate chamber **46** and, therefore, to the pilot light nozzle **17** and to the main burner **16** (see FIG. **1***a*).

The valve body **33** further provides, along the duct **39** and downstream of the cutoff chamber **47**, a chamber and a respective seat, not shown in the figures, for the thermostatic shutter **43**. The shutter **43** is operatively connectable with the thermostat of the water heater **12** through the conduit "R" and with the control knob **34** for controlling the flowing of the gas to the burner **16** as function of the temperature of the water and the position of the knob **34**, in a well known manner.

The cutoff shutter **42** can be opened solely when the pilot light is on and the starting button **36** is lifted. Specifically, the valve **23** includes an electromagnet **54** for the control shutter **41** which is electrically connectable with the thermocouple **18** through the leads of the element "T". The electromagnet **54** is such to hold back the disk **51** in an open condition and at an end stop, against the action of the spring **53**, when the pilot light heats the thermocouple according to a known technique.

In the starting button **36**, the actuation stem **56** is in axis with the seat **49** and supports the cutoff shutter **42** and a return spring **57**. At rest, the spring **57** maintains the starting button **36** in the lifted position and the cutoff shutter **42** in an open condition. Moreover, a free end of the stem **56** is arranged in front of the contrast head **52** of the control shutter **41**. These components are dimensioned so that the complete depression of the button **36** up to the end stop of the electromagnet **54** causes the closing of the seat **49** by the shutter **42** and, in sequence, the shifting of the gastight disk **5**. Thus, the shutter seat **48** will be opened for the feeding of the pilot light nozzle **17** in a condition of cutoff of the gas for the burner **16**.

With the lighting of the pilot light and the button **36** depressed, the electrical current produced by the thermocouple **18** energizes the electromagnet **54**. It holds open the control shutter **41**, with flowing of the gas into the intermediate chamber **46** and the cutoff chamber **47**. The lifting of the button **36** does not modify the state of the shutter **41** but causes the opening of the cutoff shutter **42** with flowing of the gas to the main burner under the control of the thermostatic shutter **43** and its lighting by the pilot light.

According to the invention, the safety device, depicted with **61**, has such a structure to start the lighting according to an univocal procedure which ensures conditions of total protection for the user. Specifically, the depression of the starting button **36** is subordinated to a given condition of alignment, through rotation, at a predetermined angular start position. This depression causes a hooking condition, in which the cutoff shutter **42** is closed and the control shutter **41** is under the control of the thermocouple **18**.

An unhooking condition, in which the starting button **36** is released for its lifting by the return spring **57** is subordinated to a further rotation of the button. In the unhooked condition, the cutoff shutter **42** is open, whilst the control shutter **41** remains under the control of the thermocouple **18**.

The structure of the invention prevents any uncontrolled lighting of the gas in the chamber of combustion. In fact, also in the case in which the thermostatic shutter **43** is open and the user releases the starting button **36** before moving away the hand from the area of the pilot light, the main burner **16** is isolated from the inlet **37** in view of the hooking condition of the button. With safe, the gas can be lit only after the deliberate action of rotation by the user such to enable the releasing of the starting button **36**.

In detail and with reference to the FIGS. **5-8**, the lighting starting button **36** includes a head **62** with a hub **63** fixed to the end of the actuating stem **56** opposite to the free end. The head **62** has a projection **64** which is lined up with an index **66** of the valve body **33** (see FIG. **10**) when the button **36** is at the angular start position of the button **36** to give a visual indication of the reached start position.

The safety device **61** includes a pin element **67** arranged in an angularly fixed position with respect to the starting button **36** and adapted to cooperate with the hub **63** to define the above described procedure of start.

The device **61** is integrated in a starting group **68** comprising a guide sleeve **69** for the actuating stem **56** and stop elements **71** mounted adjacent to the free end of the stem **56**. The cutoff shutter **42** is slidably mounted on the stem **56** and is arrested against the stop elements **71** by a holding spring **72** opposed by the guide sleeve **69**.

The hub **63** of the button **36** has a cylindrical surface **73** providing a recessed terminal section **74**, a longitudinal notch **76** and a transversal notch **77**. The recessed section **74** is limited by an annular shoulder **78** (see FIG. **8**) and the longitudinal notch **76** begins from the shoulder **78** and continues for a certain portion of the surface **73**. The transversal notch **77** crosses the notch **76** and extends symmetrically through about 30°, whilst the longitudinal notch **76** extends beyond the notch **77** in a final section **79**.

The longitudinal notch **76** is defined by two sides of guide and by a bottom that begins from the recessed section **74** and proceeds with an inclined ramp-like section toward the

surface **73** and with a descending step section **81** to which follows a basis section **82** adjacent to the step section **81**. The inclined section is such that the distance from the longitudinal axis starting button **36** increases in the sense of depression of the button.

The transversal notch **77** includes two guide margins and a bottom which is defined by the basis section **82** and by two inclined sections **83***a* and **83***b*, ascending to the surface **73**. Thus, the distance of the bottom from the longitudinal axis of the button **36** along the transversal notch increases, with the increasing of the distance from the axis of the longitudinal notch **76**. In turn, the guide margin close to the reduced section **74** is substantially coplanar with the step section **81**.

A seat **84** of the sleeve **69** (see FIG. **9**) lodges the pin element **67** with possibility of radial shifting perpendicular to the axis of the starting button **36**. A conventional inside end **86** of the pin **67** cooperates with the hub **63** and an external end **87** cooperates with a radially acting spring **88**, which pushes the pin element **67** toward the longitudinal axis of the button **36**.

In an initial condition, corresponding to the lifted position of the starting button **36**, the inside end **86** of the pin **67** projects from the seat **84** and engages the recessed terminal section **74** of the hub **63** in front of the annular shoulder **78**. It prevents the depression of the button **36** as represented in the configuration "I" shown in FIG. **6** and in FIG. **11**.

The rotation of the starting button **36** up to a reference start position causes the longitudinal notch **76** to be arranged in front of the pin element **67**, as shown in the configuration "II" of FIG. **6** and FIG. **11**, allowing the depression of the same button **36**.

Now, depressing the starting button **36**, the pin element **67** is forced to reenter in the seat **84** by the ascending section of the notch **76** against the action of the radially acting spring **88**, up to the step section **81**. The depression continuing, the spring **88** snap moves the pin element **67**, positioning the inside end **86** on the basis section **82** and, in sequence, on the final section **79** of the longitudinal notch **76**, according to the configuration "III" of FIG. **6** and the configurations "III-IV" of FIG. **11**.

The following release of the starting button **36** causes a short lifting of the button **36** under the action of the return spring **57** (to see FIG. **9**). The lifting is interrupted for the arrest of the step section **81** by the pin element **67** in a hooked position for the button **36**. Here, as shown in the configurations "IV" of FIG. **6** and "III-IV" of FIG. **11**, the pin element **67** engages the basis section **82** in the area of intersection between the notches **76** and **77**.

A limited rotation of the starting button **36** in the hooking condition, out of the angular start position, causes the pin element **67** to reenter partially in the seat **84** for the action of the ascending section **83***a* or **83***b*. Anyway, it has no effect in the releasing of the button, in view of the remaining contrast on the pin element **67** practiced by the margin of the notch **77** coplanar to the step section **81**. The rotation continuing over the extension of the transversal notch **77**, the end **86** of the pin element **67** engages the cylindrical surface **73** according to the configurations "V" of FIG. **6** and "V-VI" of FIG. **11**, whereby releasing the hub **63**. Now, the return spring **57** moves the button **36** to the lifted position, of rest, as represented in the configuration "VI" of FIG. **6**.

In the starting group **68** (FIGS. **3** and **7-10**), the guide sleeve **69** is constituted by a cylindrical body **90** with a first annular notch **89** in which the seat **84** for the pin element **67** is also defined. The radially acting spring **88** is defined by a resilient annular leaf, shaped as a cut ring, lodged in the notch **89** and having a fold **91** engaged in a hole of the annular notch **89** and an operational section which urges the outside end **87** of the pin element **67**.

The guide sleeve **69** is locked in a cylindrical hollow **92** of the valve body **33**, whilst an "O" ring **93**, in resilient material, interposed between a second annular notch of the body **90** and the cylindrical hollow **92**, assures the gas seal. The sleeve **69** has a substantially frusto-conical terminal section **94** projecting from the body **90** and a cylindrical vane **96** formed in the body **90**. The terminal section **94** defines the guide for the sliding of the stem **56** and the vane **96** is provided for guiding and receiving a portion of the hub **63**.

The return spring **57** is partially lodged in the vane **96** (FIG. **9**), around the stem **56**, interposed between the bottom of the vane **96** and a seat **97** of the hub **63**. Another "O" ring **98**, in resilient material, lodged in a seat of the terminal section **94** and opposed through a washer by the spring **57** insures the gas seal between the sleeve **69** and the stem **56**.

The cutoff shutter **42** includes a gastight disk **99**, also in resilient material, and a spring holding disk **101**. The gastight disk **99** has a surface opposed by the stop elements **71** and a hub **102** (see FIG. **3**) slidably mounted along the actuating stem **56** and having capability of gastight.

The disk **101** is shaped for receiving an end of the holding spring **72** and is provided of a hole in which the hub **102** of the disk **99** is lodged. The intermediate portion of the spring **72** is arranged around the frusto-conical section **94** and the other end of the spring **72** is lodged in an annular seat at the base of the section **94**.

The operation of the valve **23** and of the relative safety device **61** will result evident from the FIG. **3** and from the FIGS. **4***a*-**4***d*.

In the safety device **61**, as shown in FIG. **3**, the starting button **36** is at rest in a lifted position in virtue of the return spring **57**. Further, the action of the return spring **57** is prevailing and the spring **57** maintains compressed the holding spring **72**. In the lighting valve **23**, the cutoff shutter **42** is open, whilst the control shutter **41** is closed under the action of the spring **53**. The gas of the input chamber **44** cannot flow in the intermediate chamber **44** and the starting button **36** cannot be depressed for the obstacle constituted by the pin element **67** to the annular shoulder **78** of the hub **63**. It also prevents that the starting button **36** may be operated by child or inexperienced people.

In FIG. **4***a* the effects of a clockwise or counterclockwise rotation of the starting button **36** up to the angular start position are in evidence. The longitudinal notch **76** of the hub **63** is lined up with the pin element **67** and the button **36** can be freely depressed. This rotation does not produce effects on the other components, which remain in the same situation of FIG. **3**.

FIG. **4***b* shows the components of the device **61** of FIG. **3** when the starting button **36** is completely depressed beyond the position of start. During the depression, the actuating stem **56** shifts on the guide sleeve **69** toward the control shutter **41**. For the action of the holding spring **72**, the disk **99** of the shutter **42** follows the shift and slides along the stem **56**, jointly with the extension of the holding spring **72**. Reached the seat **49**, the disk **99** is arrested and isolates the cutoff chamber **47**.

The stroke of the starting button **36** continuing, the actuating stem **56** withdraws the gastight disk **51** from the seat **48** through the head **52**. It puts in communication the intermediate chamber **46** with the input chamber **44**, whilst the spring **72** maintains the gas seal of the disk **99** with the seat **49**. The depression of the button **36** is limited by the end stop condition of the holding electromagnet **64**. Now, the gas

feeds the nozzle **17** through the duct **38** and the user can proceed to the lighting of the pilot light in the safe condition of cutoff of the main burner. As consequence of the lighting, the thermocouple energizes the electromagnet **54** with holding of its mobile portion and maintenance of the open condition of the control shutter **41**.

In FIG. **4***c*, the starting button **36** has been released but the pin element **67** maintains it hooked. The end of the stem **56** is spaced away from the seat **48** and it cannot practice any action on the head **52** of the gastight disk **51**. The stop elements **71** are moved away from the seat **49**, allowing the holding spring **72** to maintain the disk **99** adherent to the seat **49** and closed the intermediate chamber **47**. In this state, whilst the gas continues to feed the pilot light, the flowing of the gas to the cutoff chamber **47** and the burner is still prevented. A possible turning off of the pilot light will cause only the closing of the control shutter **41** owing to the de-energization of the electromagnet **54**.

In FIG. **4***d* the effects of the application of a further clockwise or counterclockwise rotation of the starting button **36** beyond the angle of extension of the transversal notch **77** are shown. The releasing of the hub **63** allows the spring **57** to completely lift the button **36**. The actuation stem **56** has been shifted with respect to the guide sleeve **69** and its end is further spaced away from the control shutter **41**. In turn, the stop elements **71** have withdrawn the disk **99** from the seat **49** and compressed the holding spring **72**, with consequent opening of the cutoff chamber **47**. Thus, the gas can feed the burner **16** through the duct **39**. As in FIG. **3**, the pin element **67** is now in front of the shoulder **78** of the hub **63** preventing uncontrolled depressions of the button **36**. Also in this case, a turning off of the pilot light will cause the closing of the control shutter **41** and the isolation of the intermediate chamber and of the duct for the pilot light.

Naturally, the principle of the invention remaining the same, the embodiments and the details of construction of the safety device for a lighting valve can be widely varied with respect to what has been described and illustrated, by way of non-limitative example, without by this departing from the ambit of the present invention.

The invention claimed is:

1. A safety device (**61**) for a lighting valve (**23**) of a gas burner (**16**), comprising a starting button (**36**) provided for depression, a return spring (**57**) for returning the starting button (**36**) to a lifted position, a cutoff shutter (**42**) controlled by the starting button (**36**) and arranged upstream of the burner (**16**), a control shutter (**41**) for a pilot light nozzle (**17**), and a holding electromagnet (**54**) for said control shutter (**41**)

wherein the control shutter (**41**) is normally closed and is actuatable through the starting button (**36**) for the flowing of the gas to the pilot light nozzle (**17**), whilst the holding electromagnet (**54**) is dependent on the pilot light to hold open said control shutter (**41**), said safety device (**61**) being characterized in that

the starting button (**36**) is provided for rotation and can be depressed only for a given angular start position so that, for starting the lighting, the button (**36**) must be rotated up to said start position and subsequently depressed to close the cutoff shutter (**42**) and open the control shutter (**41**), whereby allowing the flowing of the gas to the pilot light nozzle (**17**);

said safety device (**61**) providing a hooking condition and an unhooked condition for the starting button (**36**), wherein, in the hooking condition, the cutoff shutter (**42**) is closed and the control shutter (**41**) is open under the control of the holding electromagnet (**54**) and without being influenced by the starting button (**36**); and

wherein, in the unhooked condition, the starting button (**36**) can return to the lifted position under the action of the return spring (**57**) to open the cutoff shutter (**42**) for the flowing of the gas to the burner (**16**), said unhooked condition requiring a further rotation of the starting button (**36**) spaced away from said angular start position.

2. Safety device (**61**) according to claim **1**, characterized in that it comprises a pin element (**67**) arranged in an angularly fixed position and which normally prevents the depression of the starting button (**36**), whilst said button (**36**) has a longitudinal notch (**76**), which can be lined up with the pin element (**67**) in said start position, and wherein the longitudinal notch (**76**) can slidably receive said pin element (**67**) for allowing the depression of the starting button.

3. Safety device (**61**) according to claim **2**, characterized in that said pin element (**67**) is lodged in a seat of guide (**84**) with possibility of shifting toward a longitudinal axis of the button (**36**), whilst a radially acting spring (**88**) pushes the pin element (**67**) toward said axis;

wherein the longitudinal notch (**76**) is defined by two sides of guide and by a bottom, said bottom including an inclined ramp-like section, a descending step section (**81**) and a basis section (**82**) adjacent to the step section (**81**); and

wherein, in the lifted position of the button (**36**), an end (**86**) of the pin element (**67**) projects from the seat (**84**) and, as soon as the staring button (**36**) lowers, said end (**86**) is caused to reenter in the seat (**84**) by the inclined ramp-like section and against the action of the radially acting spring (**88**);

the depression of the button (**36**) continuing, the radially acting spring (**88**) being provided for snap moving the pin element (**67**) from the step section (**81**) to said basis section (**82**), whereby determining the hooking condition of the starting button (**36**); and

said pin element (**67**) constituting an arrest for said descending step section (**81**) such to prevent the return spring (**57**) to return the starting button (**36**) to its lifted position.

4. Safety device (**61**) according to claim **3**, characterized in that the starting button (**36**) further includes a transversal notch (**77**), which crosses said longitudinal notch (**76**) adjacent to the step section (**81**) and provided for being employed by said pin element (**67**);

wherein said transversal notch (**77**) extends for a predetermined angle and has a bottom defined by said basis section (**82**) and by at least one transversal ascending section (**83***a*, **83***b*) adjacent to said basis section; and

wherein said predetermined angle is associated to the further rotation of the starting button (**36**) such that said further rotation causes the reentry of the pin element (**67**) in the seat (**84**) by said transversal ascending section with disengagement of the pin element from the transversal notch (**77**) in said unhooked condition.

5. Safety device (**61**) according to claim **1**, characterized in that it is included in a starting group (**68**) which is mounted on a valve body (**33**), said group comprising an actuating stem (**56**) for the starting button (**36**) and a guide sleeve (**69**) for said stem (**56**) and in which the cutoff shutter (**42**) is slidably mounted on said stem and is arrested against stop elements (**71**) of the actuating stem by a holding spring (**72**) opposed by said sleeve (**69**).

6. Safety device (61) according to claim 3, characterized in that it is arranged in a starting group (68) comprising an actuating stem (56) for the starting button (36) and a guide sleeve (69) for said stem (56), and wherein the cutoff shutter (42) is slidably mounted on said stem and is arrested against stop elements (71) of the stem (56) by a holding spring (72) opposed by the sleeve, said seat of guide (84) being provided in the guide sleeve (69) and said radially acting spring (88) being mounted on said sleeve.

7. Safety device (61) according to claim 6, characterized in that the guide sleeve (69) comprises an annular notch (89) also defining said seat of guide (84) and in which the radially acting spring (88) is constituted by an elastic annular leaf lodged in said annular notch (89) and having a section (91) engaging in a hole of said annular notch and another section adapted to cooperate with another end of said pin element (67).

8. Safety device (61) according to claim 5, characterized in that the guide sleeve (69) is locked in a cylindrical hollow section (92) of the valve body (33) and in which there is provided a gastight "O" ring (93) interposed between an annular notch of the sleeve and said cylindrical section (92).

9. Safety device (61) according to claim (5), characterized in that it comprises a pin element (67) arranged in an angularly fixed position and which normally prevents the depression of the button (36), and wherein the starting button (36) has a longitudinal notch (76) which can be lined up with the pin element (67) in the said angular starting position,

wherein said longitudinal notch (76) can slidably receive said pin element (67) for allowing the depression of the said button (36), and

wherein the starting button (36) includes a hub (63) on which said notch (76) is formed, said guide sleeve (69) having a terminal section (94) with a guide for the sliding of the actuating stem (56) and a vane (96) adapted to receive a portion of said hub (63), the return spring (57) being lodged in said vane (96), around the stem, interposed between said terminal section (94) and a seat (97) of said hub (63).

10. Safety device (61) according to claim 9, characterized in that it further includes a gastight "O" ring (98), which is interposed between a gasket seat of the sleeve and said actuating stem (56) and wherein said gasket seat is obtained in said vane (96) and is opposed by the return spring (57) of the starting button (36).

11. Safety device (61) according to claim 5, characterized in that, in the hooking condition (FIG. 4C) of the starting button (36), the cutoff shutter (42) is disengaged from the stop elements (71) and closes a seat shutter (49) for the burner (16) under the action of its holding spring (72).

12. Safety device (61) according to claim 5, characterized in that the cutoff shutter (42) is formed by a gastight disk (99) in resilient material and by a spring holding disk (101), in which said gastight disk (99) includes a surface opposed by the said stop elements (71) and a hub (102), wherein said hub (102) is slidable in gastight manner along said actuating stem (56), and wherein the spring holding disk (101) is shaped for receiving an end of the holding spring (72) and provides a hole in which the hub (102) of the said gastight disk (99) is lodged.

13. Safety device (61) according to claim 5, characterized in that it is used in a lighting valve in which said control shutter (41) comprises a gastight disk (51) and a contrast head (52), wherein said gastight disk (51) is spring urged toward the position of closing and in which the contrast head is actuatable by the actuating stem (56) of the starting button (36) in its depressed position, said actuating stem (56) being spaced away from said contrast head (52) in the hooking position at the starting button (36).

14. Safety device (61) according to claim 5, characterized in that the valve body (33) comprises an inlet (37) for the input of the gas, an input chamber (44), an intermediate chamber (46), a cutoff chamber (47), a duct (38) for the pilot light, and an output duct (39) for the gas burner (16);

wherein the input chamber (44) is gas connected with said inlet (37), the duct for the pilot light is gas connected with said intermediate chamber (46), and the output duct (39) is gas connected with said cutoff chamber (47); and

wherein the intermediate chamber (46) is interposed between the input chamber (44) and the cutoff chamber (47) and is gas connected with the input chamber (44) through a seat (48) for the control shutter (41), and with the cutoff chamber (47) through a seat (49) for the cutoff shutter (42);

in the condition of closing of the control shutter (41), the intermediate chamber (46) being gas insulated from the inlet (37) and, in the condition of closing of the cutoff shutter (42), the cutoff chamber (47) and the output duct (39) are insulated from the inlet (37).

15. A safety device (61) for a lighting valve (23) of a gas burner (16), comprising a starting button (36) and a return spring (57) for the starting button, said device being characterized in that it further comprises

a hub (63), associated with the starting button (36) and having an annular shoulder (78), a longitudinal notch (76) which interrupts said annular shoulder and a transversal notch (77) which crosses said longitudinal notch;

a contrast element (67) arranged on the trajectory of depression of the hub (63) so as to normally prevent the depression of the button (36) and in which said longitudinal notch (76) can be lined up with the contrast element (67) for a predetermined angular start position of the button (36) so as to allow the depression of the said button (36);

a hooking section (81) in said longitudinal notch (76) engageable by said contrast element (67) to hold back in a hooking condition said button (36) against the action of the return spring (57); and

an unhooking section (ascending sections 83*a* and 83*b*) in said transversal notch (77) engageable by the contrast element in response to a further rotation of the starting button (36) for an action of disengagement from the hooking section (81) which allows the lifting of the starting button (36) by the return spring (57).

16. Safety device (61) for a lighting valve (23) according to claim (15) further comprising a control shutter (41) which is actuatable through the starting button (36), a holding electromagnet (54) for said shutter depending on the pilot light and a cutoff shutter (42) depending on the starting button (36) and arranged upstream of the burner (16), the said device being characterized in that

the depression of the starting button (36) allowed by the longitudinal notch (76) ensures the opening of the control shutter (41) for the lighting of the pilot light; and

the hooking condition puts the starting button (36) in an operational state in which the cutoff shutter (42) is closed and the control shutter (41) is open under the control of the holding electromagnet (54);

the lifting of the button (36) by the return spring (57), after the unhooking, ensuring the opening of the cutoff shutter (42) for the flowing of the gas to the burner (16) and under the control of the pilot light.

* * * * *